Although the water is thought of as attached only to the negative ion, both ions would appear to be hydrated, on this hypothesis.

The arrangement suggested is but a modification of the Grotthus' chain. It is difficult to avoid the conclusion that the facts on the chemical side are such as require some such explanation of the phenomena, and that we are justified in asking physicists to re-examine the arguments which have led them to take exception to the Grotthus explanation. FitzGerald has already spoken with no uncertain voice and given us his support, in his memorial lecture on Helmholtz. Of late years probably no one has shown greater power of appreciating all sides of the position: his adverse criticism of the dissociation hypothesis is therefore of peculiar value.

The Effect of Pressure upon Arc Spectra. No. I.—*Iron.*

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(Abstract.)

The first part of the paper contains a description of the mounting and adjustment of the large Rowland Concave Grating in the Physical Laboratory of the Manchester University. The feature of this is the stability of the carriages carrying the grating and camera, and the novel construction and attachment of the cross-beam, which secure the absence of any disturbance which might be caused by bending or sagging.

The second part describes experiments made with a pressure cylinder designed by Mr. J. E. Petavel, F.R.S., in which an arc is formed between metal poles opposite a glass window, through which the light is examined by means of the Grating Spectroscope. A system of mirrors allows the image of the arc, however unsteady it may be, to be kept almost continuously in focus upon the slit.

Two sets of photographs of the iron arc in air have been taken for pressures ranging from 1 to 101 atmospheres (absolute), and the results are given below for wave-lengths $\lambda = 4000$ Å.U. to $\lambda = 4500$ Å.U.

I. *Broadening.*

1. With increase of pressure all lines become broader.
2. The amount of broadening is different for different lines, some almost

becoming bands at high pressures, and others remaining comparatively sharp.

3. The broadening may be symmetrical or unsymmetrical; in the latter case the broadening is greater on the red side.

II. *Displacement.*

1. Under pressure the most intense portion of every line is displaced from the position it occupies at a pressure of 1 atmosphere.

2. Reversed as well as bright lines are displaced.

3. With increase of pressure the displacement is towards the red side of the spectrum.

4. The displacement is real and is not due to unsymmetrical broadening.

5. The displacements are different for different lines.

6. The lines of the iron arc can be grouped into series according to the amounts of their displacements.

7. Three groups can in this way be distinguished from one another; the displacements of Groups I, II, III bear to one another the approximate ratio 1 : 2 : 4. (The existence of a Fourth Group is suggested by the behaviour of two lines, but further evidence is needed upon this point; 1 : 2 : 4 : 8 would be the approximate relations existing between the four Groups.)

8. Though all the lines examined, with two possible exceptions, fall into one or other of these Groups, the lines belonging to any one Group differ to an appreciable extent among themselves in the amounts of their displacements.

9. The relation between the pressure and the displacement is in general a linear one, but some photographs taken at 15, 20, and 25 atmospheres pressure give readings incompatible with this relation. Other photographs at 15 and 25 atmospheres present values which are compatible with it.

10. The abnormal readings are approximately twice those required by the displacements at other pressures, if the displacement is to be a continuous and linear function of the pressure throughout.

11. On the photographs showing abnormal displacements the reversals are more numerous and broader than they are on plates giving normal values, and there is some evidence in favour of a connection between the occurrence of abnormal displacements and the tendency of the lines to reverse.

III. *Reversal.*

1. As the pressure is increased, reversals at first become more numerous and broader.

2. The tendency of the lines to reverse reaches a maximum in the

neighbourhood of 20 to 25 atmospheres, and a further increase in pressure reduces their number and width.

3. Two types of reversal appear on the photographs, symmetrical and unsymmetrical.

4. Within the range of pressure investigated, the reversals show no tendency to change their type.

5. In the case of unsymmetrically reversed lines in the electric arc, the reversed portion does not in general correspond to the most intense part of the emission line, being usually on its more refrangible side.

6. The displacements of the reversed parts of the unsymmetrically reversed lines of Group III are about one-half the displacements of the corresponding emission lines. Indeed, the reversed parts of the lines of Group III fall approximately in Group II.

7. No relation between the order of reversal and the frequency of vibration, such as exists in the spark, has been observed in the iron arc for the ranges of wave-length and pressure examined.

IV. *Intensity.*

1. The intensity of the light emitted by the iron arc is, under high pressures, much greater than at normal atmospheric pressure.

2. Changes in relative intensity of the lines are produced by pressure. Lists of enhanced and weakened lines are given.